



Missouri Department of Natural Resources

Biological Assessment Study Report

**Sandy Creek
Putnam County**

September 2010 – March 2011

Prepared for:

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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**) Water Protection Program (**WPP**), MDNR's Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Sandy Creek. Sandy Creek flows through a rural watershed in Putnam County in northern Missouri.

On the 2002 303(d) list, the entire 3-mile class "C" section of Sandy Creek was listed as impaired for unknown pollutant(s) and unknown source(s) by the U. S. Environmental Protection Agency (**USEPA**). At that time a total of nine Missouri streams were listed by USEPA for unknown pollutants and sources. No specific reason was given for listing Sandy Creek. Sandy Creek remained on the 2008 list for unknown pollutant(s) and unknown source(s), but was not included on the 2010 303(d) list.

A biological and habitat assessment study was conducted during the Fiscal Year (**FY**) of 2008 (MDNR 2008). Results from the FY08 study were determined inconclusive. For this study (FY11) four control streams within the same Ecological Drainage Unit (**EDU**) were sampled. An EDU is a region where biological communities and habitat conditions can be expected to be similar. Biological reference (**BIOREF**) streams in this EDU are typically class "P" and are larger than the class "C" Sandy Creek study reach. A total of four control streams of similar size and habitat availability were chosen for comparison with Sandy Creek.

On August 9, 2010 a study plan was submitted to the WPP (Appendix A). See Section 1.4 for the null hypotheses stated in the study plan. Null hypotheses for biological assessments are included in the plan.

1.1 Purpose

The purpose of this study was to determine if the Sandy Creek macroinvertebrate community was impaired and, if so, determine the possible causes.

1.2 Objectives

- Determine if the macroinvertebrate community of Sandy Creek is impaired.
- Determine the habitat characteristics of Sandy Creek and the four control streams.
- Define the water quality characteristics of Sandy Creek and the four control streams.

1.3 Tasks

- Conduct a biological assessment of the macroinvertebrate community of Sandy Creek and the four control streams.
- Conduct a habitat assessment of Sandy Creek and the four control streams.
- Conduct a water quality assessment of Sandy Creek and the four control streams.

1.4 Null Hypotheses

- Macroinvertebrate assemblages are similar between Sandy Creek and BIOREF streams.
- Macroinvertebrate assemblages are similar between Sandy Creek and control streams.
- Macroinvertebrate assemblages are similar among Sandy Creek stream segments.
- Macroinvertebrate assemblages will not differ between the two sample seasons.

2.0 Study Area

Sandy Creek originates just south of the town of Mendota. It flows southeast through its rural watershed of grassland, forest, and cropland (Table 1) until its confluence with Shoal Creek northwest of Glendale. The four control streams flow through rural watersheds in Grundy County (Owl Branch and Tributary to No Creek) and Daviess County (Tributary to Hickory Creek and Big Muddy Creek).

According to Chapter 7 of the State Water Quality Standards, 10 CSR 20-7.031 (MDNR 2010a), a 3-mile segment of Sandy Creek is designated class “C.” That segment begins at sec. 19, T. 66 N., R. 17 W. and ends at the confluence with Shoal Creek at NW ¼ NE ¼ sec. 28, T. 66 N., R. 17 W. Beneficial use designations are for livestock and wildlife watering, protection of warm water aquatic life, human health—fish consumption, and whole body contact recreation B.

Sandy Creek and the four control streams are located within the Central Plains/Grand/Chariton EDU. See Appendix B for a map of EDUs and the 14-digit Hydrologic Units Codes (**HUC**) that contain the sampling reaches for Sandy Creek. See Table 1 for a comparison of land use for the EDU and the 14-digit HUCs for Sandy Creek and the four control streams.

Table 1
Percent Land Cover

	14-digit HUC	Urban	Cropland	Grassland	Forest	Wetland	Open Water
Central Plains/ Grand/Chariton EDU		2	28	45	18	-	-
Sandy Creek Stations	10280201110003	1	13	52	29	0	1
Trib. to No Creek	10280102180002	1	15	66	11	4	-
Owl Branch	10280102170003	8	32	43	11	3	1
Trib. to Hickory Creek	10280101160002	2	35	40	17	3	0
Big Muddy Creek	10280101180001	2	44	38	12	1	0

2.1 Water Quality Concerns

Agricultural activities, including row crops and cattle pasture as well as confined animal feeding operations (**CAFO**), dominate the landscape in northern Missouri, including the

Sandy Creek basin. Erosion of agricultural land is a major cause of sediment contribution to northern Missouri streams. Oftentimes row crops are planted to the edge of stream banks, thus eliminating stabilizing riparian vegetation. This practice causes the banks to become unstable, steep, and without shade results in higher summer water temperatures and loss of habitat.

Historic coal mining was an activity that may affect the watershed in Sandy Creek, as well as other parts of northern and western Missouri. Coal mining in northern Missouri, including the Sandy Creek watershed, has ceased. The most recent mining occurred in the Sandy Creek watershed in the early to mid 1990s. The formerly coal mined land in the Sandy Creek watershed either has been reclaimed or is in the final stages of reclamation. Mining in the Sandy Creek watershed was extensive. It was conducted up to and along the stream bank for a considerable distance, starting at the most upstream sample station and continuing upstream along the northeast bank (personal communication, MDNR Land Reclamation Program, Jan. 2009). Not only can coal mining disturb stream banks, but it can also be a source of acid mine drainage and sulfates.

2.2 Site Descriptions

2.2.1 Sandy Creek

Three Sandy Creek sampling locations were selected for this study as well as the four control stations. Sandy Creek sample stations were located in Putman County (see map Appendix B). The average width, drainage areas in square miles (**miles²**), and discharge measurements in cubic feet per second (**cfs**) during both survey periods are given for each Sandy Creek and control stream sampling station in Table 2.

The sample stations are typical of the northern portion of the Central Plains/Grand/Chariton EDU with steep banks, predominantly sand bottom with some fine silt, and little if any rock or gravel substrate. As mentioned in Section 1.0, all Sandy Creek sample stations are within the class "C" segment of the stream.

Sandy Creek Stations #1 and #2 were sampled during the FY08 study, with the addition of Station #0.5 for this study. Station #0.5 was the farthest reasonably accessible downstream point, yet required a considerable walk to reach the site.

Sandy Creek Station #0.5 (SE ¼ sec. 29, T. 66 N., R. 17 W.) is located downstream of what is historically indicated as "Osage Trail" on some maps. Geographic coordinates at the upstream terminus of this station are UTM Grid 15, East 514445, and North 4482424.

Sandy Creek Station #1 (NW ¼ sec. 29, T. 66 N., R.17 W.) is located just downstream of the first small tributary entering the creek downstream of the Highway YY crossing in Putman County. Geographic coordinates at the upstream terminus of this station are UTM Grid 15, East 513720, and North 4483029.

Sandy Creek Station #2 (E ½ sec. 19, T. 66 N., R. 17 W.) is located just upstream of the Calamint Road crossing in Putnam County. Geographic coordinates at the downstream terminus of this station are UTM Grid 15, East 512855, and North 4484205.

One important note to make about Station #2 is that there is the potential for confusion when referencing the study area map. Both lists of impaired waters from 2002 and 2008 have Sandy Creek listed as impaired from its confluence with Shoal Creek all the way to sec. 19, T. 66 N., R. 17 W, but only the 2008 list provides specific geographic coordinates for the upstream end of the listed segment. In the previous study, GIS information included Station #2 within the listed portion of the stream. In agreement with WPP to allow for consistency and in consideration of the limited accessibility to Sandy Creek, Station #2 was sampled for this study as well, in spite of being slightly upstream of the most recent list.

2.2.2 Control Streams

Four control streams with one station on each were selected for comparison with Sandy Creek. As previously mentioned, these stations were selected because they were more comparable with Sandy Creek in size and habitat availability. These stations have been sampled previously by ESP, so this provides an opportunity to build on data already generated from them.

Overall these control stations tend to be somewhat smaller than Sandy Creek stations. However, habitat was similar with limited depositional areas, rootmat, and woody debris. All control stations were class “U” (unclassified) except Big Muddy Creek which was class “C.”

Tributary to No Creek (SE ¼ sec. 35, T. 62 N., R. 23 W) is located just downstream of 80th Avenue between Dunlap and Galt in Grundy County. Geographic coordinates at the upstream terminus of this station are UTM Grid 15, East 462258, and North 4441227.

Owl Branch (NE ¼ sec. 14, T. 62 N., R. 24 W) is located just downstream of NE 20th Avenue east-northeast of Tindall in Grundy County. Geographic coordinates at the upstream terminus of this station are UTM Grid 15, East 452494, and North 4447240.

Tributary to Hickory Creek (SE ¼ sec. 32, T. 62 N., R. 27 W) is located just upstream of Beacon Road east-northeast of Coffey in Daviess County. Geographic coordinates at the downstream terminus of this station are UTM Grid 15, East 418569, and North 4441455.

Big Muddy Creek (sec. 30, T. 61 N., R. 27 W) is located just upstream of Forest Avenue north of Jameson in Daviess County. Geographic coordinates at the downstream terminus of this station are UTM Grid 15, East 416659, and North 4434008.

Table 2
Sandy Creek and Control Streams Physical Characteristics of the Stations

Sandy Creek Station #	Average Width (feet)	Drainage Area (miles ²)	Fall 2010 Flow (cfs)	Spring 2011 Flow (cfs)
0.5	36	12.4	7.6	2.1
1	52	11.2	6.5	2.1
2	46	7.3	5.8	1.4
Trib. to No Cr.	13	1.4	*	0.5
Owl Branch	33	2.1	0.3	0.4
Trib. to Hickory Cr.	17	1.5	0.1	0.4
Big Muddy Cr.	26	32.2	2.9	3.7

* Unable to conduct discharge measurements; estimated at <0.5 cfs

3.0 Methods

Sampling at the four control stations and Sandy Creek was conducted in the fall on September 14 and 15, 2010 and in the spring on March 14 and 15, 2011. Sampling was conducted by Brian Nodine and Dave Michaelson of ESP. Sampling consisted of macroinvertebrate collection and water quality sampling. Habitat assessments on Sandy Creek as well as the four control stations were conducted during the fall 2010 sampling season.

For quality control purposes, duplicate samples were collected for water quality and macroinvertebrates at Sandy Creek Station #1 during the spring sampling season. For duplicate macroinvertebrate samples, both samplers collected adjacent to each other for each grab in each habitat. Those duplicate results are reported as from Stations #1A and #1B.

3.1 Habitat

Row crop agriculture land use can be associated with instream habitat problems. These problems are often the result of erosion, sedimentation, hydrologic changes, and channelization. Although instream habitat features can be directly measured, the causes of habitat degradation are difficult to pinpoint and can range from local to watershed scale sources. For this study, habitat measurements were collected at the watershed, reach, and local scales to facilitate assessment of the causes of poor habitat conditions.

3.1.1 Land Use

Land cover data were derived from the Thematic Mapper satellite data from 2001-2004 and interpreted by the Missouri Resource Assessment Partnership (**MoRAP**). See Section 2.0 and Table 2 for land use information.

3.1.2 Habitat Assessment

A standardized habitat procedure for Glide/Pool stream types was followed in the Stream Habitat Assessment Project Procedure (**SHAPP**) (MDNR 2010b).

3.2 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements were collected at all stations for temperature (°C), dissolved oxygen concentration (mg/L), conductivity (µS/cm), and pH. These measurements followed Standard Operating Procedures MDNR-FSS-101 Field Measurement of Water Temperature (MDNR 2010c), MDNR-WQMS-103 Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter (MDNR 2009a), MDNR-FSS-102 Field Analysis for Specific Conductance (MDNR 2010d), and MDNR-FSS-100 Field Analysis of Water Samples for pH (MDNR 2009b), respectively. Additionally, water samples were collected and analyzed by ESP's Chemical Analysis Section (**CAS**) for chloride, total phosphorus, ammonia-N, nitrate + nitrite-N, and total nitrogen. Because of exceptionally high conductivity levels at all three Sandy Creek stations and considering the history of coal mining in the watershed, sulfates also were analyzed by CAS. Turbidity (**NTU**) was analyzed by the WQMS.

Stream discharge in cubic feet per second (**cfs**) was measured at each sampling station using a Marsh-McBirney Flo-Mate Model 2000. Discharge was calculated per the methods in the Standard Operating Procedure MDNR-FSS-113 Flow Measurement in Open Channels (MDNR 2010e).

Physicochemical data were summarized and presented in tabular form for comparison among the three Sandy Creek stations and between sample seasons.

3.3 Macroinvertebrate Collection and Analysis

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2010f). Three standard habitats, non-flowing water with depositional substrate (**NF**), large woody debris (**SG**), and rootmat (**RM**) at the stream edge, were sampled at all locations.

A standardized sample analysis procedure was followed as described in the SMSBPP. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index (**MSCI**). The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**).

Macroinvertebrate data were analyzed in three specific ways. First, Sandy Creek stations were compared to biological criteria for the Central Plains/Grand/Chariton EDU. Second, a longitudinal comparison between the three Sandy Creek sites was performed. Finally, a comparison was made of Sandy Creek data between fall and spring sampling seasons. See Tables 10 and 11 for biological criteria for warm water reference streams in the Central Plains/Grand/Chariton EDU for the fall and spring.

4.0 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were followed as described in pertinent Standard Operating and Project Procedures.

5.0 Data Results and Analyses

5.1 Land Use

According to MoRAP land cover files (see Table 1), the watershed land use of Sandy Creek is mostly grassland followed by cropland with some forest. A very small area of the land in the Sandy Creek drainage is urban, wetland, or open water. The majority of land use of the control watersheds is grassland followed by cropland and forest with the exception of the Big Muddy Creek watershed, in which the majority of land use is cropland followed by grassland and forest. Like the Sandy Creek watershed, very small areas of the control stream watersheds are urban, wetland, or open water.

5.2 Habitat Assessment

Habitat assessment scores were recorded for each sampling station. Results are presented in Table 3. According to the project procedure guidance, the total score from the physical habitat assessment of the study sites should be at least 75% of the total score of the habitat assessment(s) of a control station(s) to support a similar biological community. Habitat scores for the three Sandy Creek stations were compared with those of the four control streams. All three Sandy Creek stations met the 75% threshold for both the percent mean habitat score for all control stations as well as the highest scoring control station. It is therefore inferred that based on habitat scores, the three Sandy Creek stations should support comparable biological communities.

One notable parameter regarding habitat assessments was the lack of epifaunal substrate/available cover. For the three Sandy Creek stations and the four control stations, all seven had epifaunal substrate/available cover that were below seven percent.

Table 3
 Habitat Scores (Fall 2010)

Control Stream	Habitat Score	Sandy Creek Station #	Habitat Score	% of Mean Control Score	% of Max. Control Score
Trib. to No Cr.	90	0.5	87	105	97
Owl Br.	72	1	93	112	103
Trib. to Hickory Cr.	84	2	77	93	86
Big Muddy Cr.	86				
Mean Control Score	83				

5.3 Physicochemical Data

In situ water quality measurements and turbidity are summarized in Table 4 (fall 2010) and Table 5 (spring 2011). Mean temperatures at Sandy Creek stations were 22.2°C and 5.7°C in the fall 2010 and spring 2011 surveys, respectively.

Sandy Creek conductivity levels were consistent among stations within seasons. Spring season conductivity was slightly higher. Conductivity levels at the control stations were noticeably lower during both seasons compared to the Sandy Creek stations.

Sandy Creek dissolved oxygen levels were consistent among stations within seasons and did not fall below the Water Quality Standards minimum concentration for warm-water and cool-water fisheries (5.0 mg/L) even though they did fall below the minimum concentration at two of the control stations during the fall sampling season. Typically, dissolved oxygen levels are higher during the spring season when water temperatures are cooler. Sandy Creek turbidity levels were consistent within sampling seasons and were particularly lower during the spring season.

Table 4
In situ Water Quality Measurements and Turbidity at all Stations (Fall 2010)

Station	Parameter				
	Temp. (°C)	Diss. O ₂ (mg/L)	Cond. (µS/cm)	pH	Turb. (NTU)
Sandy Cr. #0.5	21.6	7.70	485	8.1	36
Sandy Cr. #1	22.6	7.58	501	8.1	36
Sandy Cr. #2	22.4	7.31	470	8.4	44
Trib. to No Cr.	19.9	4.15	195	7.2	117
Owl Branch	24.8	4.53	331	7.7	17
Trib. to Hickory Cr.	23.8	5.07	231	8.1	17
Big Muddy Cr.	19.3	7.75	186	7.4	85

Table 5
In situ Water Quality Measurements and Turbidity at all Stations (Spring 2011)

Station	Parameter				
	Temp. (°C)	Diss. O ₂ (mg/L)	Cond. (μS/cm)	pH	Turb. (NTU)
Sandy Cr. #0.5	3.6	12.59	650	8.1	3.14
Sandy Cr. #1	6.1	12.02	632	8.3	4.34
Sandy Cr. #2	7.5	10.99	642	8.1	3.87
Trib. to No Cr.	3.8	11.92	222	8.2	9.29
Owl Branch	8.7	10.93	327	8.0	2.99
Trib. to Hickory Cr.	10.6	10.64	375	8.2	4.97
Big Muddy Cr.	10.5	11.05	351	8.1	10.8

Nutrient, chloride, and NFR concentrations for all stations and sulfate concentrations for Sandy Creek stations are presented in Table 6 (fall 2010) and Table 7 (spring 2011). Among Sandy Creek stations, most nutrient concentrations were consistent among stations within seasons with the exception of ammonia at Station #0.5 during the fall season. All chloride levels were below chronic criteria for protection of aquatic life and drinking water supply.

At Sandy Creek, sulfate combined with chloride levels did not exceed the 1000 mg/L Missouri Water Quality Standards criteria for seven (7)-day Q₁₀ low flow of less than 1.0 cfs for the protection of aquatic life (MDNR 2009a).

Table 6
 Nutrient, Chloride, and NFR Concentrations at all Stations and Sulfate Concentrations for Sandy Creek (Fall 2010)

Station	Sample #	Parameter (mg/L)						
		NH ₃ -N	NO ₃ + NO ₂ -N	Total N	Total P	Chloride	NFR	Sulfate
Sandy Cr. #0.5	1006877	1.14	0.19	0.96	0.16	7.79	36.0	94.9
Sandy Cr. #1	1006878	0.14	0.15	0.88	0.14	7.33	40.0	102
Sandy Cr. #2	1006879	0.11	0.14	0.89	0.16	7.85	32.0	91.9
Trib. to No Cr.	1000858	0.10	0.07	1.26	0.36	4.56	91.0	
Owl Branch	1000859	0.08	0.53	1.08	0.09	3.51	6.00	
Trib. to Hickory Cr.	1000860	0.10	<0.01	1.25	0.26	8.53	5.00	
Big Muddy Cr.	1000861	0.12	1.00	2.11	0.31	8.12	62.0	

Table 7

Nutrient, Chloride, and NFR Concentrations at all Stations and Sulfate Concentrations for Sandy Creek (Spring 2011)

Station	Sample #	Parameter (mg/L)						
		NH ₃ -N	NO ₃ + NO ₂ -N	Total N	Total P	Chloride	NFR	Sulfate
Sandy Cr. #0.5	1104206	0.10	0.04	0.29	0.012	6.44	<5	224
Sandy Cr. #1A	1104207	0.11	0.03	0.30	0.014	6.78	5.00	224
Sandy Cr. #1B	1104208	0.12	0.03	0.30	0.013	6.89	5.00	229
Sandy Cr. #2	1104209	0.047	0.02	0.28	<0.01	7.63	<5	242
Trib. to No Cr.	1104202	<0.03	0.12	0.33	0.024	5.25	5.00	
Owl Branch	1104203	<0.03	<0.01	0.19	0.024	5.20	<5	
Trib. to Hickory Cr.	1104204	<0.03	0.06	0.33	0.035	13.2	12.0	
Big Muddy Cr.	1104205	0.045	0.03	0.43	0.056	8.33	9.00	

5.4 Biological Assessment

5.4.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)

The SMSBPP evaluation used biological criteria that were calculated for the Central Plains/Grand/Chariton EDU from ESP's Wadeable/Perennial Biological Reference Stream database. See Biological Criteria for Wadeable/Perennial Streams of Missouri (MDNR 2002) for more explanation. These criteria are listed for fall and spring seasons in Tables 8 and 9, respectively. Macroinvertebrate Stream Condition Index sustainability scores of 20-16 qualify as fully supporting, 14-10 as partially supporting, and 8-4 as non-supporting of the designated beneficial use of protection of warm water aquatic life.

Table 8
 Biological Criteria for Warm Water Reference Streams in the Central Plains/Grand/Chariton EDU (Fall Season)

Metric	Score = 5	Score = 3	Score = 1
TR	>52	27-52	<27
EPTT	>8	5-8	<5
BI	<7.3	8.6-7.3	>8.6
SDI	>2.68	1.35-2.68	<1.35

Table 9
 Biological Criteria for Warm Water Reference Streams in the Central Plains/Grand/Chariton EDU (Spring Season)

Metric	Score = 5	Score = 3	Score = 1
TR	>50	25-50	<25
EPTT	>7	4-8	<4
BI	<7.4	8.7-7.4	>8.7
SDI	>2.52	1.27-2.52	<1.27

5.4.2 Comparisons with Regional Reference Streams in the Central Plains/Grand/Chariton EDU

Macroinvertebrate Stream Condition Indices were calculated for Sandy Creek and the four control stations as derived from biological criteria from Central Plains/Grand/Chariton EDU reference streams. The four metrics, total scores, and MSCI supportability rankings during fall 2010 and spring 2011 are presented in Tables 10 and 11, respectively.

Table 10
 Metric Values and Stream Condition Indices, Fall 2010 Sampling Season

Station	Sample #	TR	EPTT	BI	SDI	MSCI	Supportability
Sandy Cr. #0.5	1004105	72	15	6.5	3.29	20	Fully
Sandy Cr. #1	1004106	69	15	6.8	3.14	20	Fully
Sandy Cr. #2	1004107	75	15	6.7	3.54	20	Fully
Trib. to No Cr.	1004101	57	3	8.0	3.04	14	Partially
Owl Br.	1004102	55	3	6.4	2.86	16	Fully
Trib. to Hickory Cr.	1004103	68	3	7.4	3.30	14	Partially
Big Muddy Cr.	1004104	79	12	6.8	3.05	20	Fully

Table 11
 Metric Values and Stream Condition Indices, Spring 2011 Sampling Season

Station	Sample #	TR	EPTT	BI	SDI	MSCI	Supportability
Sandy Cr. #0.5	110314	54	11	7.0	3.08	20	Fully
Sandy Cr. #1A	110315	53	7	7.3	3.04	16	Fully
Sandy Cr. #1B	110316	50	5	7.4	3.04	14	Partially
Sandy Cr. #2	110317	50	9	7.1	3.01	18	Fully
Trib. to No Cr.	110310	45	4	7.5	2.11	12	Partially
Owl Br.	110311	52	5	6.9	2.69	18	Fully
Trib. to Hickory Cr.	110312	55	5	7.8	2.52	14	Partially
Big Muddy Cr.	110313	56	6	7.4	2.67	16	Fully

5.4.3 Sandy Creek Comparisons with Control Streams

With the exception of the duplicate sample collected at Station #1, all Sandy Creek samples received a fully supporting rank for both seasons. By comparison, only Owl Branch and Big Muddy Creek received fully supporting scores for both seasons whereas Tributary to No Creek and Tributary to Hickory Creek failed to receive a fully supporting score in either season.

5.4.4 Sandy Creek Longitudinal Comparisons

All Sandy Creek stations received fully supporting rankings during both seasons with the exception of the duplicate for Station #1. During the fall season, all three stations received an MSCI score of 20 whereas spring season MSCI scores (the duplicate notwithstanding) ranged from 16 to 20.

The SMSBPP requires duplicate macroinvertebrate samples to be collected at ten percent of all bioassessment stations for quality control purposes. The Quantitative Similarity Index for Taxa (**QSIT**) is used to compare taxa similarity between duplicate macroinvertebrate samples. According to the SMSBPP, duplicate samples are expected to have a similarity of at least 70% (MDNR 2010e). The QSIT for the two duplicates collected at Sandy Creek Station #1 met this criterion with a QSIT = 83.1%

5.4.5 Sandy Creek Seasonal Comparisons

There were no differences in supportability rankings between seasons, with all receiving fully supporting scores, with the exception of Duplicate B at Station #1 during the spring sampling season, which received a partially supporting score. However, the only Sandy Creek station to receive the same MSCI score between seasons was Station #0.5.

5.4.6 Macroinvertebrate Percent and Community Composition

Percent EPT, percent Diptera, relative abundance, and top five dominant families are presented in Table 12 for the fall sampling season and Table 13 for the spring sampling season. The percent of relative abundance data were averaged from the sum of the three macroinvertebrate habitats (depositional non-flow, woody debris, and rootmat) sampled at each station.

Diptera was the dominant order at all three Sandy Creek stations as well as all four control stations during both sampling seasons with Chironomidae being the dominant family at all stations.

Table 12
 Fall 2010 Macroinvertebrate Composition (percentages rounded to whole numbers)

Station	Sandy Cr.			Trib. to No	Owl Br.	Trib. to Hickory	Big Muddy
	0.5	1	2				
% Ephemeroptera	38	32	24	3	2	1	6
% Plecoptera	0	0	0	0	0	0	0
% Trichoptera	5	1	4	0	0	0	0
Total EPT %	43	33	28	3	2	1	6
% Diptera	52	60	59	55	69	63	79
% Top Five Dominant Families							
Chironomidae	47	56	47	51	50	33	74
Baetidae	22	18	9				3
Caenidae	13	12	11				
Hydropsychidae	5						
Heptageniidae	2						
Hyalellidae		3		10			
Ceratopogonidae		2	8				
Ephemeridae			4				
Tubificidae				15	6	9	5
Physidae				6	9	16	4
Coenagrionidae				3			
Tipulidae					16	8	2
Lymnaeidae					6		
Chaoboridae						6	

Table 13
 Spring 2011 Macroinvertebrate Composition (percentages rounded to whole numbers)

Station	Sandy Cr.				Trib. to No	Owl Br.	Trib. to Hickory	Big Muddy
	0.5	1A	1B	2				
% Ephemeroptera	12	9	12	5	6	3	0	2
% Plecoptera	0	0	0	0	0	1	0	0
% Trichoptera	3	4	2	7	0	3	1	0
Total EPT %	15	13	14	12	6	7	1	2
% Diptera	83	85	84	86	86	88	95	94
% Top Five Dominant Families								
Chironomidae	80	82	82	83	78	82	92	84
Caenidae	8	7	10	2				1
Heptageniidae	4	2	2	3		3		1
Hydropsychidae	3	4	2	7				
Simuliidae	2	3	2	2			2	10
Tubificidae					3		2	1
Limnephilidae						3	1	
Ceratopogonidae					6	2	1	
Tipulidae						2		
Leptophlebiidae					6			
Enchytraeidae					1			

6.0 Discussion

Unlike the FY08 Sandy Creek study, this study shows Sandy Creek to be fully supporting of the protection of warm water aquatic life designated use at all three stations sampled, with the only exception being the duplicate sample at Station #1 during the spring sampling season. The duplicate sample, however, was only one taxon short of attaining a fully supporting MSCI score of 16.

As mentioned in the introductory section, a biological assessment study was conducted in FY08 with inconclusive results. Both study stations (#1 and #2) had partially supporting MSCI scores for both seasons.

There are no definitive physicochemical results to explain the differences in the results between the two studies.

A possible factor in the different MSCI scores and supportability rankings could be the difference in the amount of water present in Sandy Creek between the two study years. At both FY08 study stations the fall sampling season flow measurements were below 0.1 cfs and one station during the spring was below 0.1 cfs. During this current study, flow was noticeably higher with the minimum flow during the fall being greater than 5.0 cfs

and the minimum flow in the spring at 1.4 cfs. The flow pattern observed in this study was atypical; usually there is more flow in the spring than fall seasons.

As mentioned in the Site Description section, Sandy Creek has a predominantly sand substrate with little habitat. Most depositional habitats are predominantly sand with some silt and little to no organic material. Woody debris habitats in Sandy Creek are predominantly more recently fallen trees, logs, and limbs with little older, more easily colonized material for macroinvertebrates. The rootmat habitat also is very limited, especially during lower flow periods.

Given the limited nature of good habitat in Sandy Creek, combined with a period of low flow could, at least in part, explain the lower MSCI scores for FY08.

Because all three Sandy Creek stations received fully supporting rankings during both seasons using BIOREF data, there was no need to make comparisons with the control streams. Nevertheless it is worth commenting on the scores of those sites.

Owl Branch and Big Muddy Creek are the only two control streams to receive fully supporting rankings during both sample seasons, whereas Tributary to No Creek and Tributary to Hickory Creek only received partially supporting rankings.

Owl Branch and especially Big Muddy Creek are much more comparable to Sandy Creek than the other two control streams. Like Sandy Creek, Owl Branch and Big Muddy Creek have predominantly flat, sand substrates whereas the tributaries to No Creek and Hickory Creek are more “ditch”-like with narrower bank-to-bank widths and channels and more clay and silt substrates than sand. Big Muddy Creek also was more comparable to Sandy Creek in size and flow as the only control station with flow greater than 1.0 cfs during both seasons.

7.0 Conclusions

Based on this study, there may be a conclusion drawn that Sandy Creek is biologically sustainable to benthic macroinvertebrates. From the information in this study, conditions for macroinvertebrate sustainability were improved compared to the FY08 study.

8.0 Summary

- The null hypothesis that macroinvertebrate assemblages are similar between Sandy Creek and BIOREF streams in the same EDU is accepted.
- The null hypothesis that macroinvertebrate assemblages are similar between Sandy Creek stations and control streams is rejected.
- The null hypothesis that macroinvertebrate assemblages are similar among Sandy Creek stream segments is accepted.
- The null hypothesis that macroinvertebrate assemblages will not differ between the two sample seasons is accepted.

9.0 Literature Cited

Missouri Department of Natural Resources. 2002. Biological Criteria for Wadeable/Perennial Streams of Missouri. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 32 pp.

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Missouri Department of Natural Resources. 2009b. Field Analysis of Water Samples for pH. MDNR-ESP-100. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 10 pp.

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Missouri Department of Natural Resources. 2010b. Stream Habitat Assessment Project Procedure (SHAPP). MDNR-ESP-032. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 40 pp.

Missouri Department of Natural Resources. 2010c. Field Measurement of Water Temperature. MDNR-ESP-101. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 2 pp.

Missouri Department of Natural Resources. 2010d. Field Analysis for Specific Conductance. MDNR-ESP-102. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 15 pp.

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Missouri Department of Natural Resources. 2010e. Flow Measurement in Open Channels. Standard Operating Procedure MDNR-ESP-113. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 9 pp.

Missouri Department of Natural Resources. 2010f. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. MDNR-ESP-030. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 24 pp.

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BA:bnt

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Appendix A

Proposed Bioassessment Study Plan
Sandy Creek
August 9, 2010

Missouri Department of Natural Resources
Bioassessment Study Plan, FY 11
Sandy Creek, Putnam County
August 9, 2010

Objective

This study will characterize the macroinvertebrate communities in Sandy Creek at three sites within the 3 miles of 303(d) listed section. The objective of this study is to determine if aquatic macroinvertebrate life is impaired along the listed section of Sandy Creek.

Null Hypotheses

- 1). Macroinvertebrate communities in Sandy Creek will not differ significantly from macroinvertebrate communities of reference streams within the Central Plains/Grand/Chariton Ecological Drainage Unit (**EDU**).
- 2). Macroinvertebrate communities in Sandy Creek will not differ significantly from macroinvertebrate communities in four control streams with similar classification within the Central Plains/Grand/Chariton EDU.
- 3). Macroinvertebrate communities will not differ significantly between the three longitudinally separate reaches of Sandy Creek
- 4). Macroinvertebrate communities will not differ significantly between the two sample seasons.

Background

Sandy Creek begins just south of Mendota in northeastern Putnam County and flows southeast to its confluence with Shoal Creek northwest of Glendale. A three (3) mile segment from Sec. 19, T 66 N, R 17 W to NE Sec. 28, T 66 N, R 17 W (see attachment) is listed on the 303(d) list as impaired by unknown causes. Streams may become listed by U. S. Environmental Protection Agency (**EPA**) for unknown causes for a variety of reasons. The goal of this study is to evaluate the listed segment of Sandy Creek for biological impairment.

A previous biological assessment and habitat study of Sandy Creek was conducted during Fiscal Year (**FY**) 08. The data from that study was determined to be inconclusive.

Study Design

General: Three Sandy Creek stations will be surveyed including the original two surveyed during the FY 08 study (Stations # 1 and 2). The site locations are: Station 0.5 at the crossing of what was historically labeled “Osage Trail” on the map with UTM coordinates E. 514273, N. 4482503 at the upstream terminus (landowner permission pending). 1) Just below the first small tributary downstream of the Highway YY crossing with UTM coordinates E.513704, N.

4483031 at the upstream terminus. 2) Just upstream of the Calamint Road crossing with UTM coordinates at E. 512838, N. 4484207 at the downstream terminus.

At each station, the length sampled will extend 20 times the average stream width as outlined in MDNR-WQMS-032 (MDNR 2003b). To assess comparability between sampling stations and reference streams, stream discharge, habitat assessment and water chemistry will be determined during macroinvertebrate surveys. Sampling will be conducted during the fall of 2010 (mid September through mid October) and the spring of 2011 (mid March through mid April).

Four control streams within the same EDU and same classification will also be surveyed for comparison with the three Sandy Creek stations. These streams are: Owl Creek and a tributary of No Creek in Grundy County and Big Muddy Creek and a tributary of Hickory Creek in Daviess County.

Biological Sampling Methods: Macroinvertebrates will be sampled as per the guidelines of the Semi-Quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003a). Sandy Creek will be considered a “glide/pool” predominant stream; therefore samples will be collected from flow over depositional (non-flow), root-mat, and wood debris (snag) habitats. Each macroinvertebrate sample will be a composite of six subsamples, except for woody debris, which is a composite of twelve.

Habitat Sampling Methods: A standardized habitat procedure for Glide/Pool stream types will be followed in the Stream Habitat Assessment Project Procedure (**SHAPP**) guidelines of MDNR-FSS-032 (MDNR 2003b). Habitat assessments will be conducted during the fall 2010 sampling season at all three Sandy Creek stations and the four control streams

Water Quality Sampling Methods: Stream discharge will be measured at each sampling location using a Marsh-McBirney flow meter. Water samples from all sampled stations will be analyzed at the ESP laboratory for ammonia, nitrogen as $\text{NO}_2 + \text{NO}_3$, total nitrogen, total phosphorus, chloride, non-filterable residue (**NFR**), and turbidity. Field measurements will include pH, conductivity, temperature, and dissolved oxygen.

Because of historic coal mining in the immediate vicinity of Sandy Creek and elevated conductivity levels during the FY 08 study, sulfates will also be analyzed in the water samples from Sandy Creek.

Laboratory Methods: All samples of macroinvertebrates will be processed and identified per MDNR-FSS-209, Taxonomic Levels for Macroinvertebrate Identification (MDNR 2005). Turbidity samples will be analyzed at the MDNR biological laboratory.

Data Recording and Analyses: Macroinvertebrate data will be entered in a Microsoft Access database in accordance with MDNR-WQMS-214, Quality Control Procedures for Data Processing (MDNR 2003c). Data analysis is automated within the Access database. Four standard metrics are calculated according to the SMSBPP: Total Taxa (TT); Ephemeroptera, Plecoptera, Trichoptera Taxa (EPTT); Biotic Index (BI); and the Shannon Index (SI) will be calculated for each reach.

Macroinvertebrate data will be analyzed in two ways. First, a longitudinal comparison between the three Sandy Creek reaches will be performed. Secondly, the data from the Sandy Creek sites will be compared to biological criteria from wadeable/perennial reference streams with similar geology and watershed size classification.

Data Reporting: Results of the study will be summarized and interpreted in report format.

Quality Control: As stated in the various MDNR Project Procedures and Standard Operating Procedures.

References:

Missouri Department of Natural Resources. 2003a. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. MDNR-FSS-030. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 24 pp.

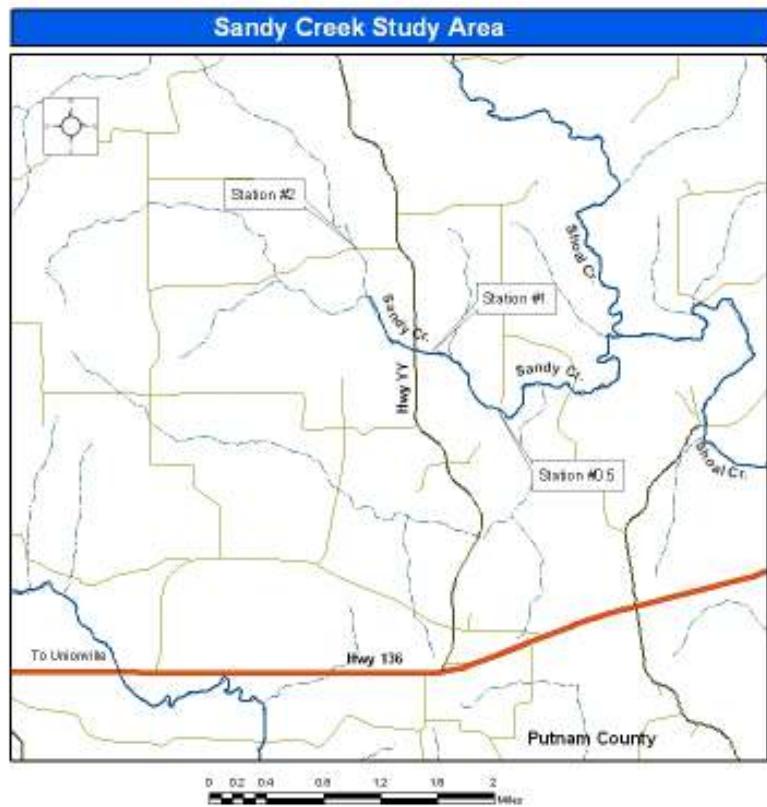
Missouri Department of Natural Resources. 2003b. Stream Habitat Assessment Project Procedure (SHAPP). MDNR-FSS-032. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 40 pp.

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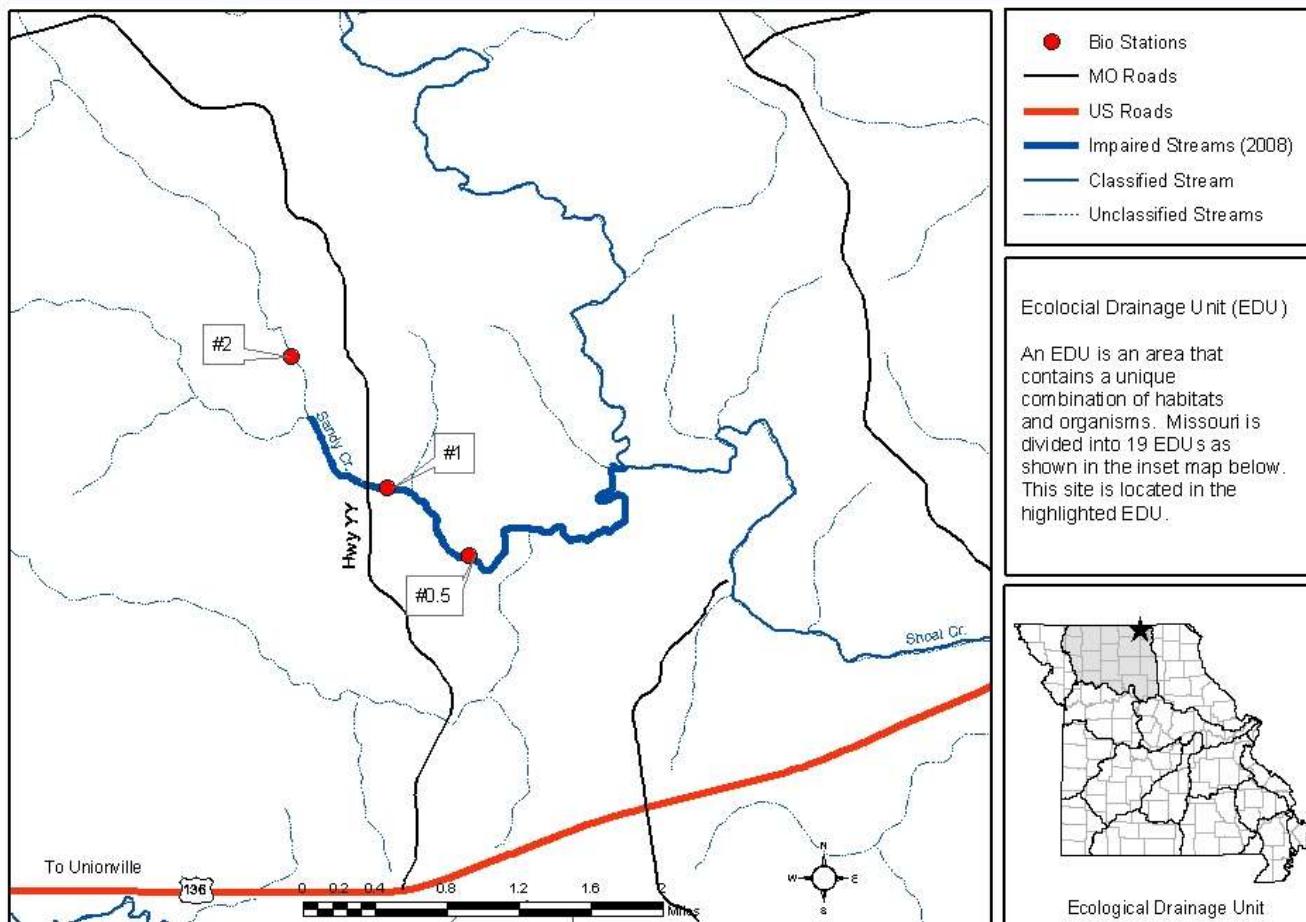
Attachments

Map of all sampling stations in this study



Appendix B
Sandy Creek Study Area Map

Sandy Creek Study Area (FY 11)



Appendix C
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [1004105], Station #0.5, Sample Date: 9/15/2010 2:55:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	1	8	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Berosus	1		
Dytiscidae	1		
Enochrus		1	
Helichus basalis		2	
Helichus lithophilus		2	
Scirtidae	1		
DECAPODA			
Orconectes virilis		1	
DIPTERA			
Ablabesmyia	8	3	4
Ceratopogoninae	6		1
Chaoborus	6		
Chrysops	2		
Cladotanytarsus	21	1	

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004105], Station #0.5, Sample Date: 9/15/2010 2:55:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Corynoneura	1	3	
Cricotopus bicinctus	2	3	3
Cricotopus/Orthocladius			2
Cryptochironomus	5	1	
Culicidae		1	
Dicrotendipes	18	3	44
Forcipomyiinae	1		2
Glyptotendipes			1
Gonomyia			2
Labrundinia	1		
Larsia		1	1
Nanocladius	1	3	
Ormosia	4		
Paracladopelma	7		2
Paralauterborniella	1		
Paratanytarsus	8	1	
Polypedilum aviceps	3	20	13
Polypedilum fallax grp		1	
Polypedilum halterale grp	4		

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004105], Station #0.5, Sample Date: 9/15/2010 2:55:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Polypedilum illinoense grp	23	21	18
Polypedilum scalaenum grp	4	1	1
Psychodidae		1	
Rheocricotopus		1	
Rheotanytarsus	1	1	
Saetheria	1		
Simulium		6	2
Stempellinella	27		1
Stenochironomus			1
Tanytarsus	65	17	
Thienemanniella		5	
Thienemannimyia grp.	1	12	1
Tipula	1	2	

EPHEMEROPTERA

Acerpenna	3	13	4
Baetis	2	8	45
Caenis latipennis	32	65	9
Fallceon		31	23
Heptagenia		3	1

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004105], Station #0.5, Sample Date: 9/15/2010 2:55:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Hexagenia limbata	15		
Leptophlebiidae		3	
Paracloeodes	4	19	21
Procloeon	4		2
Stenacron		8	1
Stenonema femoratum		1	1
Tricorythodes	1	1	
HEMIPTERA			
Corixidae	2		
Microvelia	1		
Neoplea	2		
Trepobates	1		
LIMNOPHILA			
Physella			1
ODONATA			
Calopteryx	-99	3	
Enallagma	1	1	
Gomphidae	1		
Progomphus obscurus	2		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [1004105], Station #0.5, Sample Date: 9/15/2010 2:55:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
TRICHOPTERA			
Cheumatopsyche	3	26	14
Hydropsyche		1	
Nectopsyche		1	
TUBIFICIDA			
Enchytraeidae		2	
VENEROIDA			
Pisidiidae	1		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [1004106], Station #1, Sample Date: 9/15/2010 5:00:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
"HYDRACARINA"			
Acarina	1		
<hr/>			
AMPHIPODA			
Hyalella azteca	1	23	1
<hr/>			
BRANCHIOBDELLIDA			
Branchiobdellida		4	
<hr/>			
COLEOPTERA			
Berosus		1	
Ilybius		1	
Scirtidae		5	
<hr/>			
DECAPODA			
Orconectes virilis		1	
<hr/>			
DIPTERA			
Ablabesmyia	5	5	
Ceratopogoninae	12	1	
Chaoborus	2		
Chironomidae	5		
Chironomus	1	1	
<hr/>			

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004106], Station #1, Sample Date: 9/15/2010 5:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Cladotanytarsus	25		7
Corynoneura			1
Cricotopus bicinctus		3	
Cryptochironomus	8		1
Cryptotendipes	1		
Dasyheleinae	7		
Dicrotendipes	4	4	85
Dolichopodidae	1		
Ephydriidae	3		
Forcipomyiinae			1
Hemerodromia		1	
Ormosia	3		
Paracladopelma	2		
Paralauterborniella	5		1
Paratanytarsus		9	2
Phaenopsectra		1	
Polypedilum convictum		17	3
Polypedilum halterale grp	14		
Polypedilum illinoense grp	6	57	19

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004106], Station #1, Sample Date: 9/15/2010 5:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Polypedilum scalaenum grp	5		2
Procladius	2		
Pseudosmittia	1		
Rheotanytarsus		7	8
Saetheria	3	1	
Simulium		3	1
Stempellinella	20		
Stenochironomus			5
Tanytarsus	123	8	36
Thienemanniella	1		
Thienemannimyia grp.	1	8	11
Tipula		1	

EPHEMEROPTERA

Acerpenna		4	3
Baetis		6	54
Caenis latipennis	23	69	16
Caenis punctata		2	1
Callibaetis		1	
Fallceon		18	14

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004106], Station #1, Sample Date: 9/15/2010 5:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Heptagenia		4	1
Hexagenia limbata	11		
Paracloeodes	1	31	24
Procloeon	5	1	4
Stenacron	1		4
Stenonema femoratum		2	
HEMIPTERA			
Belostoma		1	
Corixidae	1	1	
Microvelia		3	
Neoplea		2	
LIMNOPHILA			
Physella		1	
ODONATA			
Argia		1	
Calopteryx		7	2
Enallagma		1	
Erythemis		1	
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [1004106], Station #1, Sample Date: 9/15/2010 5:00:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Cheumatopsyche			8
Nectopsyche		3	
Polycentropus		2	
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Enchytraeidae	1		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [1004107], Station #2, Sample Date: 9/15/2010 7:10:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
"HYDRACARINA"			
Acarina	4	1	
<hr/>			
AMPHIPODA			
Hyalella azteca	1	17	1
<hr/>			
ARHYNCHOBDELLIDA			
Erpobdellidae	1		
<hr/>			
BRANCHIOBDELLIDA			
Branchiobdellida		1	
<hr/>			
COLEOPTERA			
Berosus	2		
Enochrus		2	2
Scirtidae		14	1
Tropisternus		6	
<hr/>			
DECAPODA			
Orconectes virilis		-99	
<hr/>			
DIPTERA			
Ablabesmyia	4	5	2
Ceratopogoninae	50	2	
<hr/>			

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004107], Station #2, Sample Date: 9/15/2010 7:10:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Chaoborus	7	1	
Chironomus	8	1	
Cladotanytarsus	16	5	1
Corynoneura		2	
Cricotopus bicinctus		3	
Cryptochironomus	13		1
Cryptotendipes	3		
Culiseta	1		
Dicrotendipes	5	5	11
Diptera	1		
Dolichopodidae		1	
Ephydriidae	1		
Forcipomyiinae	1		
Glyptotendipes	1	1	
Larsia	5	2	
Natarsia		1	
Nemotelus	1		
Ormosia	2		
Pagastiella	1		

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004107], Station #2, Sample Date: 9/15/2010 7:10:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Paracladopelma	2		1
Paralauterborniella	5		
Paratanytarsus	2	5	
Pericoma	1		
Phaenopsectra		1	
Polypedilum aviceps	1	28	
Polypedilum convictum		1	
Polypedilum halterale grp	6		
Polypedilum illinoense grp	5	57	8
Polypedilum scalaenum grp	2	1	
Procladius	2		
Rheotanytarsus		2	1
Simulium		8	
Stempellinella	16		
Stratiomys	2		
Tanytarsus	45	13	1
Thienemanniella		3	
Thienemannimyia grp.	2	5	5
Tipula	1	1	

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004107], Station #2, Sample Date: 9/15/2010 7:10:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Zavrelimyia	1	6	
EPHEMEROPTERA			
Acerpenna	2	1	4
Baetis		8	19
Brachycercus	1		
Caenis latipennis	39	26	1
Caenis punctata	1	2	3
Fallceon		2	1
Heptagenia		1	1
Hexagenia limbata	27		
Paracloeodes	1	10	5
Procloeon			2
Pseudocloeon		1	7
Stenacron		2	
Stenonema femoratum	1		
GORDIOIDEA			
Gordiidae	2		
HEMIPTERA			
Corixidae	5		

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [1004107], Station #2, Sample Date: 9/15/2010 7:10:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Microvelia		4	1
ISOPODA			
Lirceus	1		
LIMNOPHILA			
Physella	5	2	
ODONATA			
Argia		2	
Calopteryx		4	
Progomphus obscurus			1
TRICHOPTERA			
Cheumatopsyche	3	22	
Nectopsyche		1	
TUBIFICIDA			
Enchytraeidae	1	2	
Tubificidae	3		

Aquid Invertebrate Database Bench Sheet Report

Trib. No Cr [1004101], Station #1, Sample Date: 9/14/2010 11:20:00 AM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	3	12	4
AMPHIPODA			
Crangonyx	1		
Hyalella azteca	2	62	10
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
COLEOPTERA			
Laccobius		2	
Ochthebius		1	
Paracymus		1	
Scirtidae		13	
DIPTERA			
Ablabesmyia	2	3	
Anopheles		1	
Ceratopogoninae	5	2	3
Chaoborus	3		
Chironomidae	3	1	

Aquid Invertebrate Database Bench Sheet Report**Trib. No Cr [1004101], Station #1, Sample Date: 9/14/2010 11:20:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Chironomus	6	2	
Chrysops	1	1	
Cladotanytarsus	11	2	
Clinotanypus	1	1	
Cryptochironomus	3		
Cryptotendipes	1		
Dasyheleinae	2		
Dicrotendipes	10	7	6
Dolichopodidae	2		
Endochironomus		1	
Glyptotendipes	12	15	3
Kiefferulus	1	2	
Nanocladius	1		
Ormosia		1	
Parachironomus	1		
Paratanytarsus	15	42	1
Paratendipes	2		
Phaenopsectra	4	10	3
Pilaria	2	1	

Aquid Invertebrate Database Bench Sheet Report**Trib. No Cr [1004101], Station #1, Sample Date: 9/14/2010 11:20:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Polypedilum halterale grp	3		
Polypedilum illinoense grp	4	17	
Procladius	100	4	1
Stenochironomus			2
Tanypus	2		
Tanytarsus	49	11	4
Thienemannimyia grp.		1	1
undescribed Empididae		2	
Zavrelimyia		1	1
EPHEMEROPTERA			
Caenis latipennis	10	4	
Hexagenia limbata	10		
HEMIPTERA			
Microvelia		1	
LEPIDOPTERA			
Crambidae		1	
LIMNOPHILA			
Lymnaeidae		1	3
Menetus		2	

Aquid Invertebrate Database Bench Sheet Report**Trib. No Cr [1004101], Station #1, Sample Date: 9/14/2010 11:20:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Physella	8	25	12
ODONATA			
Argia		7	
Enallagma	1	15	
Plathemis			1
TRICHOPTERA			
Phryganeidae	1		
TUBIFICIDA			
Aulodrilus	7		
Enchytraeidae	2		
Limnodrilus hoffmeisteri	2		
Tubificidae	89	1	10
VENEROIDA			
Pisidiidae	4		

Aquid Invertebrate Database Bench Sheet Report

Owl Br [1004102], Station #1, Sample Date: 9/14/2010 1:50:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
"HYDRACARINA"			
Acarina	1		1
<hr/>			
AMPHIPODA			
Hyalella azteca		4	-99
<hr/>			
COLEOPTERA			
Berosus	1		
Enochrus	-99		2
Helichus basalis		1	2
Helichus lithophilus		1	
Laccobius			-99
<hr/>			
DIPTERA			
Ablabesmyia	2	3	1
Anopheles		2	1
Ceratopogoninae	3	2	4
Chaoborus			1
Chironomus	2		2
Cladotanytarsus	154	7	8
Culicidae	1		1

Aquid Invertebrate Database Bench Sheet Report**Owl Br [1004102], Station #1, Sample Date: 9/14/2010 1:50:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Dicrotendipes	4	1	1
Dolichopodidae	-99	1	1
Forcipomyiinae	1		
Gonomyia	40	29	31
Kiefferulus	1		
Larsia		2	
Limnophyes	3	2	6
Ormosia	1		2
Paraphaenocladius		1	
Paratanytarsus		1	
Paratendipes	1		
Phaenopsectra		1	1
Pilaria		1	
Polypedilum convictum			1
Polypedilum halterale grp	6		
Polypedilum illinoense grp		6	3
Polypedilum scalaenum grp	4	1	3
Procladius	2	1	
Pseudosmittia	3	3	9

Aquid Invertebrate Database Bench Sheet Report**Owl Br [1004102], Station #1, Sample Date: 9/14/2010 1:50:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Psychodidae		2	
Saetheria	20	5	1
Stenochironomus			5
Tanypus	1		
Tanytarsus	6	9	11
Thienemannimyia grp.	2	4	1
Tipulidae			2
Zavrelimyia	2	15	5
EPHEMEROPTERA			
Caenis latipennis	3	2	2
Paracloeodes		8	2
HEMIPTERA			
Hebrus		1	
Microvelia		10	7
Trichocorixa			2
LIMNOPHILA			
Lymnaeidae	2	4	31
Physella	9	30	19
ODONATA			

Aquid Invertebrate Database Bench Sheet Report

Owl Br [1004102], Station #1, Sample Date: 9/14/2010 1:50:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Calopteryx	1	1	
Gomphidae			1
Progomphus obscurus	1	1	1
TRICHOPTERA			
Phryganeidae	2		1
TUBIFICIDA			
Enchytraeidae	1	1	5
Limnodrilus hoffmeisteri		1	
Tubificidae	1	39	2

Aquid Invertebrate Database Bench Sheet Report

Trib. Hickory Cr [1004103], Station #1, Sample Date: 9/14/2010 5:00:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
"HYDRACARINA"			
Acarina	1		
<hr/>			
AMPHIPODA			
Hyalella azteca	2	1	
<hr/>			
ARHYNCHOBDELLIDA			
Erpobdellidae	1		
<hr/>			
COLEOPTERA			
Agabus		2	
Berosus	3		
Dytiscidae			1
Dytiscus	2		
Helichus basalis			1
Paracymus		1	
Scirtidae			1
<hr/>			
DIPTERA			
Ablabesmyia	3		
Aedes	3	3	1
Allognosta			1

Aquid Invertebrate Database Bench Sheet Report**Trib. Hickory Cr [1004103], Station #1, Sample Date: 9/14/2010 5:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Anopheles	2	1	
Ceratopogoninae	22	9	5
Chaoborus	23	11	10
Chironomus	3		
Cladotanytarsus	21		1
Culex	1		
Culicidae	2		
Dasyheleinae	2		
Dicrotendipes		1	1
Diptera	3	5	2
Dolichopodidae	6	6	5
Ephydriidae	1		
Forcipomyiinae	1		
Gonomyia	13	17	
Hemerodromia		1	
Larsia	1		
Limnophyes	1	8	3
Mesosmittia			1
Ormosia	5	11	1

Aquid Invertebrate Database Bench Sheet Report**Trib. Hickory Cr [1004103], Station #1, Sample Date: 9/14/2010 5:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Paracladopelma	12	1	4
Paraphaenocladius	3	8	1
Pericoma	3		
Phaenopsectra	2	1	
Pilaria	1	1	
Polypedilum aviceps	1	1	1
Polypedilum halterale grp	16		1
Polypedilum illinoense grp	9	13	4
Polypedilum scalaenum grp	6	4	1
Procladius	2		
Pseudosmittia	16	30	5
Psychoda	7		1
Smittia	1	1	
Stempellinella		2	
Stenochironomus			1
Stratiomys		1	
Tabanus	4	8	
Tanytarsus	23	14	
Thienemannimyia grp.		2	

Aquid Invertebrate Database Bench Sheet Report**Trib. Hickory Cr [1004103], Station #1, Sample Date: 9/14/2010 5:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Tipula	5	5	
Zavrelimyia	1	1	
EPHEMEROPTERA			
Caenis latipennis	1	3	1
Heptageniidae			1
HEMIPTERA			
Corixidae	1		
Gerridae	2	2	
LEPIDOPTERA			
Crambidae	1		
LIMNOPHILA			
Lymnaeidae	13	16	7
Physella	54	49	8
LUMBRICINA			
Lumbricina		6	
LUMBRICULIDA			
Lumbriculidae	1	1	
ODONATA			
Calopteryx		1	

Aquid Invertebrate Database Bench Sheet Report

Trib. Hickory Cr [1004103], Station #1, Sample Date: 9/14/2010 5:00:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Progomphus obscurus	-99		
TRICHOPTERA			
Leptoceridae		1	
TUBIFICIDA			
Enchytraeidae	1	4	1
Limnodrilus hoffmeisteri	2		
Tubificidae	38	14	12

Aquid Invertebrate Database Bench Sheet Report

Big Muddy Cr [1004104], Station #1, Sample Date: 9/15/2010 9:30:00 AM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
"HYDRACARINA"			
Acarina	1	1	
<hr/>			
COLEOPTERA			
Berosus		2	
Helichus basalis		2	
Helichus lithophilus		1	
Scirtidae	1	1	
<hr/>			
DECAPODA			
Orconectes immunis	1		
<hr/>			
DIPTERA			
Ablabesmyia	27	20	7
Anopheles	1		
Ceratopogoninae	3	2	1
Chaoborus	1		
Chironomidae	4	1	6
Chironomus	9		
Cladotanytarsus	37	9	7
Cryptochironomus	5		

Aquid Invertebrate Database Bench Sheet Report**Big Muddy Cr [1004104], Station #1, Sample Date: 9/15/2010 9:30:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Cryptotendipes	9		
Dicrotendipes	4	16	55
Diptera	7		
Forcipomyiinae		1	1
Glyptotendipes	2		1
Gonomyia	9	1	6
Labrundinia		6	1
Larsia		5	1
Limnophyes		1	
Nanocladius	2	3	
Nilothauma			1
Ormosia	2		3
Paracladopelma	3		
Paralauterborniella	1		
Paraphaenocladius	1	2	17
Paratanytarsus	2	7	4
Paratendipes		1	
Pericoma	1		
Phaenopsectra		1	

Aquid Invertebrate Database Bench Sheet Report**Big Muddy Cr [1004104], Station #1, Sample Date: 9/15/2010 9:30:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
<i>Polypedilum convictum</i>	2	5	1
<i>Polypedilum halterale</i> grp	27		
<i>Polypedilum illinoense</i> grp	5	14	1
<i>Polypedilum scalaenum</i> grp	3	1	1
<i>Procladius</i>	10		
<i>Pseudosmittia</i>	1	3	22
<i>Rheocricotopus</i>		1	
<i>Rheotanytarsus</i>		2	
<i>Saetheria</i>	2		3
<i>Smittia</i>			1
<i>Stempellinella</i>	12	1	
<i>Stenochironomus</i>			17
<i>Tanytarsus</i>	48	211	73
<i>Thienemannimyia</i> grp.	3	6	1
<i>Tipula</i>		1	1
<i>Tipulidae</i>	2		1
EPHEMEROPTERA			
<i>Acerpenna</i>			1
<i>Caenis latipennis</i>	3	10	3

Aquid Invertebrate Database Bench Sheet Report**Big Muddy Cr [1004104], Station #1, Sample Date: 9/15/2010 9:30:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Fallceon			1
Hexagenia limbata	10		
Leptophlebiidae		1	
Paracloeodes	2	6	12
Procloeon	2	2	2
Stenacron			1
Stenonema femoratum		1	
HEMIPTERA			
Corixidae	3	1	1
Ranatra nigra		-99	
Rheumatobates		1	
LIMNOPHILA			
Lymnaeidae		4	2
Physella	4	40	
LUMBRICINA			
Lumbricina		1	
ODONATA			
Argia		10	4
Boyeria	1		

Aquid Invertebrate Database Bench Sheet Report**Big Muddy Cr [1004104], Station #1, Sample Date: 9/15/2010 9:30:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Enallagma	1	4	
Macromia	-99		
Progomphus obscurus	6	1	1
TRICHOPTERA			
Hydroptila			1
Nectopsyche	1		
Oxyethira			1
TUBIFICIDA			
Aulodrilus	4		
Enchytraeidae		4	9
Limnodrilus cervix	2		
Limnodrilus hoffmeisteri	1		
Limnodrilus udekemianus	1		
Tubificidae	32	6	2
VENEROIDA			
Pisidiidae	1		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110314], Station #0.5, Sample Date: 3/29/2011 11:10:00 AM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
AMPHIPODA			
<i>Hyalella azteca</i>	3	6	1
<hr/>			
COLEOPTERA			
<i>Helichus basalis</i>		1	
<hr/>			
DECAPODA			
<i>Orconectes</i>		-99	
<hr/>			
DIPTERA			
<i>Ablabesmyia</i>	4		
<i>Ceratopogoninae</i>	2	1	
<i>Chironomidae</i>	3	1	2
<i>Chironomus</i>	19		
<i>Corynoneura</i>	2	4	1
<i>Cricotopus bicinctus</i>	14	39	74
<i>Cricotopus/Orthocladius</i>	29	18	76
<i>Cryptochironomus</i>	3		
<i>Dicrotendipes</i>	2		16
<i>Eukiefferiella</i>			6
<i>Glyptotendipes</i>			1

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110314], Station #0.5, Sample Date: 3/29/2011 11:10:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Hydrobaenus	39	2	8
Micropsectra	2	1	1
Ormosia	3		
Paracladopelma	2		
Parametriocnemus			4
Paraphaenocladius	4		3
Paratanytarsus	11	24	21
Phaenopsectra	2	1	
Polypedilum convictum		13	26
Polypedilum halterale grp	20		
Polypedilum illinoense grp	3	13	3
Polypedilum scalaenum grp	3		1
Procladius	1		
Rheocricotopus			1
Rheotanytarsus	1	9	2
Saetheria	18	1	2
Simulium		8	12
Stenochironomus			4
Tanytarsus	23	10	7

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110314], Station #0.5, Sample Date: 3/29/2011 11:10:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Thienemanniella	10	29	21
Thienemannimyia grp.	12	19	29
Tipula		-99	
Zavrelimyia	4		
EPHEMEROPTERA			
Acerpenna		2	
Caenis latipennis	63		5
Centroptilum	1		
Heptagenia	2	23	4
Leptophlebiidae		1	
Stenacron	1	-99	3
Stenonema femoratum		1	
ODONATA			
Calopteryx		-99	
Ischnura		1	
Progomphus obscurus	2		
PLECOPTERA			
Amphinemura	1		
Perlesta		1	

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110314], Station #0.5, Sample Date: 3/29/2011 11:10:00 AM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
TRICHOPTERA			
Cheumatopsyche	1	10	13
Pycnopsyche	2	1	2
TUBIFICIDA			
Enchytraeidae	2		
Limnodrilus hoffmeisteri	1		
Tubificidae	2		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110315], Station #1a, Sample Date: 3/29/2011 12:50:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
AMPHIPODA			
<i>Hyalella azteca</i>	1	3	
<hr/>			
COLEOPTERA			
<i>Dubiraphia</i>		1	
<hr/>			
DECAPODA			
<i>Orconectes virilis</i>	1		
<hr/>			
DIPTERA			
<i>Ablabesmyia</i>	3	1	
<i>Ceratopogoninae</i>	2		
<i>Chironomidae</i>	1		
<i>Chironomus</i>	53		1
<i>Cladotanytarsus</i>	1		
<i>Corynoneura</i>	7	3	
<i>Cricotopus bicinctus</i>	18	58	65
<i>Cricotopus/Orthocladius</i>	12	22	110
<i>Cryptochironomus</i>	5		
<i>Dicrotendipes</i>	7	1	21
<i>Diptera</i>	1		

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110315], Station #1a, Sample Date: 3/29/2011 12:50:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Eukiefferiella		1	1
Hydrobaenus	41	1	9
Labrundinia		1	
Micropsectra		3	
Nemotelus	1		
Ormosia	1		
Parakiefferiella	1		
Parametriocnemus		1	2
Paraphaenocladius	2	6	
Paratanytarsus	10	26	10
Phaenopsectra	2	7	1
Polypedilum convictum	1	22	22
Polypedilum fallax grp		1	
Polypedilum halterale grp	4		
Polypedilum illinoense grp	8	9	3
Polypedilum scalaenum grp	9	1	
Polypedilum tritum	2		
Pseudosmittia	1		
Rheosmittia	6		

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110315], Station #1a, Sample Date: 3/29/2011 12:50:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Rheotanytarsus		5	1
Saetheria	40		7
Simulium		27	3
Stenochironomus			6
Stictochironomus	1		
Tanytarsus	26	9	5
Thienemanniella	5	23	8
Thienemannimyia grp.	13	12	5
Zavrelimyia	5	4	
EPHEMEROPTERA			
Caenis latipennis	43	23	3
Heptagenia		13	2
Stenacron			2
Stenonema femoratum	2		
ODONATA			
Calopteryx		2	
Enallagma		1	
PLECOPTERA			
Amphinemura		1	

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110315], Station #1a, Sample Date: 3/29/2011 12:50:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
TRICHOPTERA			
Cheumatopsyche	1	27	7
Pycnopsyche	1	-99	
TUBIFICIDA			
Enchytraeidae	2	1	
Tubificidae	3		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110316], Station #1b, Sample Date: 3/29/2011 12:50:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
AMPHIPODA			
<i>Hyalella azteca</i>	2	2	
<hr/>			
COLEOPTERA			
<i>Helichus lithophilus</i>		1	
<i>Scirtidae</i>		1	
<hr/>			
DIPTERA			
<i>Ablabesmyia</i>	6		
<i>Ceratopogoninae</i>	1		
<i>Chironomidae</i>	5		1
<i>Chironomus</i>	59		
<i>Cladotanytarsus</i>	1		1
<i>Corynoneura</i>	6	3	2
<i>Cricotopus bicinctus</i>	25	55	77
<i>Cricotopus/Orthocladius</i>	13	23	53
<i>Cryptochironomus</i>	6		1
<i>Dicrotendipes</i>	13	1	9
<i>Diplocladius</i>			1
<i>Eukiefferiella</i>		1	3

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110316], Station #1b, Sample Date: 3/29/2011 12:50:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Gonomyia	2		
Hemerodromia		1	
Hydrobaenus	39	1	6
Labrundinia		1	
Micropsectra	1		
Paracladopelma	1		2
Parakiefferiella	1		
Paralauterborniella	1		
Parametriocnemus			5
Paraphaenocladius	2	4	
Paratanytarsus	7	18	8
Phaenopsectra		2	3
Polypedilum convictum	6	15	33
Polypedilum halterale grp	18		
Polypedilum illinoense grp	5	15	6
Polypedilum scalaenum grp	3		1
Rheocricotopus			1
Rheosmittia			3
Rheotanytarsus		4	3

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110316], Station #1b, Sample Date: 3/29/2011 12:50:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Saetheria	12	1	18
Simulium	2	10	7
Stenochironomus			3
Tanytarsus	10	5	13
Thienemanniella	7	23	27
Thienemannimyia grp.	14	15	7
Tipula		-99	-99
Zavrelimyia	5	1	
EPHEMEROPTERA			
Acerpenna			2
Caenis latipennis	45	40	2
Centroptilum	2		
Heptagenia	1	14	2
LIMNOPHILA			
Physella		1	
TRICHOPTERA			
Cheumatopsyche	1	6	12
TUBIFICIDA			
Enchytraeidae	3		

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110316], Station #1b, Sample Date: 3/29/2011 12:50:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Tubificidae	3		1

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110317], Station #2, Sample Date: 3/29/2011 3:30:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
<hr/>			
AMPHIPODA			
<i>Hyalella azteca</i>	1	4	1
<hr/>			
COLEOPTERA			
<i>Peltodytes</i>	1		
<hr/>			
DIPTERA			
<i>Ablabesmyia</i>	1	1	
<i>Ceratopogoninae</i>	1		
<i>Chironomidae</i>	4	5	6
<i>Chironomus</i>	16	1	
<i>Cladotanytarsus</i>	2		
<i>Corynoneura</i>			2
<i>Cricotopus bicinctus</i>	36	20	33
<i>Cricotopus/Orthocladius</i>	36	25	96
<i>Cryptochironomus</i>	12		
<i>Dicrotendipes</i>	6	1	10
<i>Eukiefferiella</i>	1	3	18
<i>Hydrobaenus</i>	72	3	14
<i>Micropsectra</i>		1	

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110317], Station #2, Sample Date: 3/29/2011 3:30:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Nanocladius		2	
Odontomyia			1
Ormosia	1		
Parametriocnemus		2	1
Paraphaenocladius	1	1	
Paratanytarsus	11	22	8
Phaenopsectra	1		
Polypedilum convictum	5	13	29
Polypedilum halterale grp	5		
Polypedilum illinoense grp	2	32	20
Polypedilum scalaenum grp	3		
Procladius	1		
Rheocricotopus		2	3
Rheotanytarsus		3	3
Saetheria	37	13	7
Simulium		4	12
Tanytarsus	43	12	5
Thienemanniella	3	36	20
Thienemannimyia grp.	6	34	9

Aquid Invertebrate Database Bench Sheet Report**Sandy Cr [110317], Station #2, Sample Date: 3/29/2011 3:30:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Tipula		2	
Zavrelimyia	2	2	
EPHEMEROPTERA			
Acerpenna		2	1
Caenis latipennis	7	10	3
Heptagenia	1	15	12
Leptophlebia		1	
Stenacron		1	
HEMIPTERA			
Microvelia		1	
LIMNOPHILA			
Lymnaeidae			1
ODONATA			
Argia		1	
TRICHOPTERA			
Agrypnia		-99	
Cheumatopsyche	3	26	38
Nectopsyche		1	
Pycnopsyche	1	3	

Aquid Invertebrate Database Bench Sheet Report

Sandy Cr [110317], Station #2, Sample Date: 3/29/2011 3:30:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae		2	5

Aquid Invertebrate Database Bench Sheet Report

Trib. No Cr [110310], Station #1, Sample Date: 3/28/2011 11:00:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2		
AMPHIPODA			
Crangonyx		9	4
Hyalella azteca	2	2	
COLEOPTERA			
Agabus		1	
Helichus basalis		1	
Helophorus			1
Peltodytes	1		1
DECAPODA			
Orconectes		1	
DIPTERA			
Ablabesmyia		1	
Aedes	2		
Ceratopogoninae	42	8	1
Chironomidae	1	2	2
Corynoneura		1	1

Aquid Invertebrate Database Bench Sheet Report**Trib. No Cr [110310], Station #1, Sample Date: 3/28/2011 11:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Cricotopus bicinctus	1		
Cricotopus/Orthocladius	27	104	57
Cryptochironomus	2		
Dicrotendipes	1		3
Diplocladius	4	18	18
Ephydriidae	1		
Gonomyia	1		
Hydrobaenus	158	73	130
Paracladopelma	1		
Parakiefferiella	1	1	
Paraphaenocladius	8	19	42
Paratanytarsus	2		1
Phaenopsectra			1
Polypedilum halterale grp	2		
Polypedilum illinoense grp		2	3
Pseudolimnophila	1		
Simulium	1	2	
Stegopterna			1
Tabanus	2	2	

Aquid Invertebrate Database Bench Sheet Report**Trib. No Cr [110310], Station #1, Sample Date: 3/28/2011 11:00:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Tanytarsus	2		
Thienemannimyia grp.		3	
Zavrelimyia	4	3	1
EPHEMEROPTERA			
Caenis latipennis	2		
Heptagenia			1
Leptophlebiidae	2	48	3
HEMIPTERA			
Aquarius			1
ISOPODA			
Lirceus			1
PLECOPTERA			
Amphinemura		1	1
TRICLADIDA			
Planariidae		2	1
TUBIFICIDA			
Enchytraeidae	5	8	
Limnodrilus hoffmeisteri	6		
Tubificidae	12	8	1

Aquid Invertebrate Database Bench Sheet Report

Owl Br [110311], Station #1, Sample Date: 3/28/2011 12:40:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
COLEOPTERA			
Agabus	1	3	
Enochrus		1	
Helichus basalis		1	
Tropisternus		1	
DIPTERA			
Ablabesmyia		2	
Ceratopogoninae	5	15	
Chrysops	2	6	
Cladotanytarsus	7	1	
Corynoneura	1	3	
Cricotopus bicinctus	3	3	6
Cricotopus/Orthocladius	14	79	166
Dicrotendipes			4
Diplocladius	1	3	1
Dolichopodidae		1	
Eukiefferiella		2	3
Glyptotendipes			1

Aquid Invertebrate Database Bench Sheet Report**Owl Br [110311], Station #1, Sample Date: 3/28/2011 12:40:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Gonomyia	3	12	1
Hydrobaenus	30	27	51
Limnophyes		2	
Micropsectra	2		
Orthocladius (Euorthocladius)		1	
Parametriocnemus			1
Paraphaenocladius	1	42	18
Paratanytarsus	1	5	4
Phaenopsectra			4
Polypedilum convictum		2	
Polypedilum fallax grp			2
Polypedilum halterale grp	5		
Polypedilum illinoense grp		9	3
Polypedilum scalaenum grp	2		
Pseudolimnophila		1	
Rheotanytarsus		1	
Saetheria	28	3	3
Simulium			1
Tabanus		1	

Aquid Invertebrate Database Bench Sheet Report**Owl Br [110311], Station #1, Sample Date: 3/28/2011 12:40:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Tanytarsus		9	18
Thienemanniella	1	4	20
Thienemannimyia grp.		12	4
Tipula		1	1
Zavrelimyia	2	12	2
EPHEMEROPTERA			
Caenis latipennis		1	
Heptagenia		9	12
HEMIPTERA			
Microvelia		1	
LIMNOPHILA			
Lymnaeidae		2	
Physella	3	5	3
ODONATA			
Argia		1	
PLECOPTERA			
Amphinemura		1	
Perlidae		4	
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Owl Br [110311], Station #1, Sample Date: 3/28/2011 12:40:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Ironoquia	1	14	6
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Enchytraeidae	1	9	1
Tubificidae		5	4

Aquid Invertebrate Database Bench Sheet Report**Trib. Hickory Cr [110312], Station #1, Sample Date: 3/28/2011 3:15:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
<hr/>			
AMPHIPODA			
Crangonyx	-99		
<hr/>			
COLEOPTERA			
Agabus	-99	2	1
Paracymus			1
<hr/>			
DIPTERA			
Ablabesmyia	6	2	1
Ceratopogoninae	9	1	
Chironomidae	5		2
Chrysops	1		
Cladotanytarsus	1		
Corynoneura	2	4	4
Cricotopus bicinctus	3	4	3
Cricotopus/Orthocladius	9	63	94
Cryptochironomus	4	2	
Dicrotendipes	3	1	5
Diplocladius		4	4
Diptera	1		

Aquid Invertebrate Database Bench Sheet Report**Trib. Hickory Cr [110312], Station #1, Sample Date: 3/28/2011 3:15:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Gonomyia			1
Hydrobaenus	157	55	115
Micropsectra		2	
Nanocladius		3	
Ormosia	-99		
Parametriocnemus		2	
Paraphaenocladius	1	10	10
Paratanytarsus	2	8	3
Phaenopsectra	2	2	15
Polypedilum convictum		1	
Polypedilum fallax grp		1	3
Polypedilum halterale grp	8		
Polypedilum illinoense grp	8	33	27
Polypedilum scalaenum grp	9	1	4
Rheotanytarsus	1	3	1
Saetheria	5		4
Simulium	2	3	14
Stenochironomus			1
Stictochironomus	1		

Aquid Invertebrate Database Bench Sheet Report**Trib. Hickory Cr [110312], Station #1, Sample Date: 3/28/2011 3:15:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Tabanus	-99		
Tanytarsus	15	30	21
Thienemanniella	9	31	17
Thienemannimyia grp.	6	15	3
Tipula			-99
Zavrelimyia		2	2
EPHEMEROPTERA			
Acerpenna		1	
Heptagenia			1
Stenacron			1
LEPIDOPTERA			
Crambidae		1	
LIMNOPHILA			
Lymnaeidae			1
Physella	-99		
ODONATA			
Calopteryx	-99	1	
Coenagrionidae		1	
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Trib. Hickory Cr [110312], Station #1, Sample Date: 3/28/2011 3:15:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Ironoquia		1	
Pycnopsyche	1	6	1
TUBIFICIDA			
Enchytraeidae	6	1	
Ilyodrilus templetoni	1		
Limnodrilus claparedianus			1
Limnodrilus hoffmeisteri	2	1	
Tubificidae	12		5

Aquid Invertebrate Database Bench Sheet Report

Big Muddy Cr [110313], Station #1, Sample Date: 3/28/2011 4:45:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
N/A			
"HYDRACARINA"			
Acarina	2		
COLEOPTERA			
Agabus		1	
Scirtidae		1	
DIPTERA			
Ablabesmyia	3	3	
Ceratopogoninae	3	2	
Chironomidae	2	1	
Chrysops	1	-99	
Cladotanytarsus	2		
Corynoneura	7	6	
Cricotopus bicinctus	6	12	3
Cricotopus/Orthocladius	24	36	96
Cryptochironomus	2		
Dicrotendipes	4		6

Aquid Invertebrate Database Bench Sheet Report**Big Muddy Cr [110313], Station #1, Sample Date: 3/28/2011 4:45:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Diplocladius		1	4
Diptera	2		
Eukiefferiella		1	3
Glyptotendipes			1
Hydrobaenus	97	64	81
Labrundinia	1	2	
Nanocladius	2	4	
Paralauterborniella	1		
Parametriocnemus	2		
Paraphaenocladius	5	9	1
Paratanytarsus	25	19	9
Phaenopsectra	3	6	1
Polypedilum convictum	2	4	1
Polypedilum fallax grp		1	
Polypedilum halterale grp	16		
Polypedilum illinoense grp	18	17	4
Rheocricotopus	1	1	
Rheotanytarsus		1	2
Saetheria	5		

Aquid Invertebrate Database Bench Sheet Report**Big Muddy Cr [110313], Station #1, Sample Date: 3/28/2011 4:45:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Simulium		28	60
Stenochironomus			1
Stictochironomus	1		
Tabanus	1		
Tanytarsus	25	19	13
Thienemanniella	19	39	11
Thienemannimyia grp.	1	3	
Tipula		1	
Zavrelimyia	2	2	
EPHEMEROPTERA			
Caenis latipennis	5	5	2
Leptophlebia		1	
Stenacron	2	1	3
Stenonema femoratum	1	1	
ODONATA			
Argia		-99	
Calopteryx		1	
Enallagma		1	
Progomphus obscurus	1		

Aquid Invertebrate Database Bench Sheet Report

Big Muddy Cr [110313], Station #1, Sample Date: 3/28/2011 4:45:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
PLECOPTERA			
Perlesta		1	
TRICHOPTERA			
Cheumatopsyche		1	1
Ironoquia		3	
TUBIFICIDA			
Enchytraeidae	2	3	
Limnodrilus hoffmeisteri	1		
Tubificidae	2	5	2